RESEARCH REPORT

# SETTING FAMILY PLANNING ACCEPTOR TARGETS FOR SMALL REGIONS

P M KULKARNI

1989

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India

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# PREFACE

The concern over the consequences of rapid population growth led to the launching of family planning programmes in many countries. Initially, most programmes were clinic based, providing birth control services either free of cost or at a nominal cost to those who asked for such services. Many countries also set specific demographic goals. This led to the need to know how many acceptors of birth control methods are required to achieve the fertility decline specified in the demographic goal. These are the acceptor targets. In the extension approach that is adopted by some countries, certain government agencies are asked to undertake the responsibility of persuading individual couples to accept birth control. The acceptor targets are useful in providing guidelines to such agencies about how much work is needed. The setting of acceptor targets therefore is routinely done in most family planning programmes.

Though the setting of targets at the national level is usually done in a scientific manner, the allocation of these to sub-regions is done in proportion to population with occasional ad-hoc adjustments. In the presence of regional variations in prevalence levels, the appropriateness of such a strategy needs to be examined. This study is one such attempt.

Some of the discussion is with reference to the family planning programme in India. This is so because the problem was initially perceived in terms of the Indian programme. The distribution of targets to states, and further to districts and health centres, is a major task in the Indian programme. However, the findings and conclusions in chapters V and VI may be relevant elsewhere.

Discussions with P N M Bhat and Ramesh Kanbargi have helped in clarifying some issues. Technical assistance was provided by Ms K S Umamani, Some of the computations were done by Ms Ulhasini Kamble. Thanks are due to Mr N Boopathi and Mr M K Mohan Kumar for secretarial assistance and to Mr M Lingaraju for drawing the graphs.

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P M Kulkarni

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# SETTING FAMILY PLANNING ACCEPTOR TARGETS FOR SMALL REGIONS


## Summary

In national family planning programmes, the demographic goal is usually translated into acceptor targets that, if achieved, would lead to the designated goal. Certain techniques, called target setting procedures, are available for this purpose. These generally require information on a number of parameters and are frequently used for setting targets at the national level. For smaller areas, such procedures may appear too cumbersome and demanding and the general practice has been to allocate the national (or state) targets to smaller regions in proportion to populations. An attempt is made here to examine the appropriateness of such a procedure when the initial prevalence level varies considerably across regions.

In a set of data obtained from a target setting exercise that was done for the states in India, it is observed that the initial prevalence level has a very weak and unclear relationship with the acceptor targets. This indicates that the targets for sub-regions need not vary by the current prevalence level. A model that was developed to explore this further also supports this view.

Some numerical exercises show that prevalence rates in regions with vastly varying initial prevalence levels, when subjected to identical acceptor targets, soon converge to the common desired goal. The goal to be achieved, the method mix, and the age distribution of acceptors appear to play a more important role in target setting than the initial prevalence level.

The results have two implications. One is that the practice of allocating targets to sub-regions in proportion to population is justifiable. The second is that even after a sub-region has reached the desired prevalence level, a high acceptance rate is required to maintain that level. Finally, a simple procedure for target setting has been proposed that could be used as a rule of thumb when other procedures are thought to be too labourious.

# CHAPTER I

## INTRODUCTION

The key element of a population policy is the demographic goal to be achieved. The goal may be stated in very general terms, such as increasing or lowering the growth rate of a population, but more often than not, for most of the populations that are experiencing rapid growth at present, the goal is to ultimately reach zero population growth. Barring migration, a net reproduction rate of 1 (or an intrinsic rate of growth of 0) over a long period will ultimately bring the population to a stationary state and achieve this goal. The date by which the net reproduction rate should reach 1 (and maintain this level thereafter) may also be specified. The goal can be achieved by a number of fertility - mortality combinations. But generally there is some expectation of a future trend in mortality. The demographic goal can, therefore, be translated into a goal for fertility level that, in conjunction with the expected mortality level, would correspond to the overall demographic goal.

Theoretically, it is possible to have an infinitely large number of fertility schedules any one of which would yield the desired result. However, many of these would not have a plausible pattern of age specific fertility rates. If such a pattern is specified, a unique solution to the

problem would be possible. But it is not necessary to obtain a unique solution since any fertility schedule that achieves the desired result and is plausible will serve the purpose. It is also possible, and often convenient, to first translate the goal into the crude birth rate, with the help of projected age distributions, and the goal can then be stated in that form. In fact, often, demographic goals are stated in the form of crude birth rates to be achieved by specified dates without going through the exercise of first specifying a net reproduction rate and then computing the implied crude birth rate.

The four principal proximate determinants of fertility are : marriage, contraception, lactational amenorrhea, and abortion. If likely trends in proportions married by age group, length of breastfeeding, and abortion rates can be assumed, age specific fertility rates will correspond to a set of contraceptive prevalence rates (or couple protection rates, i.e., proportions of couples effectively practicing a contraceptive, by age of wife). The contraceptive prevalence rates at a point in time are the result of past and current acceptances of contraceptives. The prevalence rates depend not only on the number of acceptors in the past but on the age distribution of acceptors, the timing of acceptance, and continuation and effectiveness of contraceptive methods accepted. A prevalance rate

that can be achieved by a certain number of acceptors of an effective and permanent method of contraception may require many more acceptors of less effective or temporary methods. In many family planning programmes with a cafeteria approach, couples can choose from among a number of contraceptive methods. In such cases, it is not just the number of acceptors but their distribution by method (called 'method-mix') that is important. If the method-mix is fixed, either because of community preferences or because of programme limitations, and past acceptance is known, time series of numbers of acceptors to reach the desired contraceptive prevalence rates at a time point in future can be obtained. There is an intrinsic merit in expecting the change from the current prevalance levels to the desired levels at a future date to be smooth. Therefore, a reasonable path of such a change can be specified and numbers of acceptors that would yield such levels computed. These are the acceptor targets.

A number of techniques are available to arrive at the acceptor targets needed to achieve a demographic goal. Alternative sets of targets for alternate method mixes, acceptor age distributions, and paths to the ultimate goal can be obtained. The techniques often need base level prevalance rates (or data on past acceptance from which

base level prevalence rates can be computed) and projected or assumed trends in marital status distribution and mortality levels from the time the targets are set (base line) to the time the demographic goal is to be achieved. PROJTARG and TABRAP are two of the well known techniques of target setting (see Nortman et.al., 1978). Most such techniques are used for setting national targets. But the recent target setting work done by the International Institute for Population Sciences (Srinivasan et.al., 1980) is based on a scientific procedure for India as a whole as well as for individual states.

The data requirements and the complexities of the target setting procedures has probably prevented programmes from setting targets independently for smaller regions (i.e., districts, health centres). The general practice has been to allocate state targets to the smaller regions in proportion to their populations, with occasional minor and ad-hoc adjustments. This is certainly a good procedure in the case of states which are homogeneous in demographic conditions and base level contraceptive prevalence. But in many states of India there are large inter-district variations. How appropriate is a proportional allocation of targets in such a case? Besides, some programme administrators feel that in some small regions where the past acceptance has been good, the prevalence rate would

be so high that not many eligible couples would have remained as non-acceptors. What should be the targets in such cases? This study addresses these and allied questions.

Before the results are presented, some clarification on the limitations of the general approach to target setting is in order principally because the practice of setting family planning targets in the Indian family planning programme has come under severe criticism.* There are some valid reasons for this criticism. As a part of administration of the programme, targets are allocated to family planning centres and quotas are given to workers for the purpose of motivating couples to adopt a method of birth control. This is accompanied by incentives and disincentives to workers and administrative pressures for the achievement of targets. The result, often, is that the achievement of targets becomes an important end in itself, with undesirable consequences. Pressures on the workers are easily transferred to eligible couples and efforts of motivation and persuasion become strong enough to border on coercion. Besides, even if no such pressures are needed, because there is a demand for birth control from the population, the programme infrastructure should be in a position to deliver the needed services. Targets set beyond the capacity of the delivery system put undue

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* See, for example, Bose (1988).

pressure on both the programme personnel and the infrastructure adversely affecting the quality of services.

Because of apprehensions on this account, and because of lessons learned from some experiences, suggestions have been made to set targets that are compatible with the demand for birth control and the capability of the delivery system. Such targets would then be 'realistic'. But these would, clearly, be forecasts rather than targets of acceptance and would not generally lead to the demographic goal. In other words, these would give a realistic picture of the way things are likely to be in the absence of any intervention. But the existence of a programme certainly implies that a need for intervention was felt and further that there was a willingness, on the part of the policy framers, to intervene. A programme is introduced precisely because of a dissatisfaction with the way the situation is likely to be in the future, near or distant, and on the assumption that there is some scope for making an appropriate intervention to improve it. Naturally, using forecast-like targets simply because these appear realistic is not the desired solution.

This does not, of course, mean that the target setting exercise can be divorced from the realities of the demand for birth control and the ability of the delivery

system. If the delivery system is not capable of providing services that would be required to meet the targets, there should be greater inputs into it, of personnel, infrastructure, and skills. The setting of acceptor targets should, therefore, be taken to its next logical step by planning for the development of the delivery system as well. The same thing applies to the demand for birth control. But this is where the main difficulty lies. To a certain degree, the information and motivation networks can be improved to create greater demand. But demand is to a larger extent determined by the socio-economic setting and bringing about changes in this is much more difficult than simply expanding the service and communication systems. The scope of family planning programmes is generally limited, with little, if any, role in activities related to socio-economic development. It is true that other arms of the government (as well as non-governmental forces) are involved in the promotion of overall development and the family planning programme need not enter this area for its own sake. But bringing about improvements in levels of living, literacy, status of women, and allied factors has not generally been an easy task. If such factors do not reach a level that is needed to create the targetted demand for family planning, such targets cannot be achieved except with the help of a strategy of compulsion.

As long as this is not desired, and is not expected to be practiced, the targets would be unachievable and to that extent unrealistic. This implies further that the demographic goal is itself unattainable. The goal should be such that the interventions that are available should be able to achieve it in an anticipated socio-economic situation. Once such a goal has been set, the targets can be worked out and the required interventions made. This is not easy to do in a systematic manner because of two reasons. First, though the general direction of the effect of socio-economic factors on demand for fertility limitation is known, quantification has not been easy. Second, the changes in these variables are not easy to forecast. In practice, often, an achievable goal is identified by judgement. The targets can only be as appropriate as this goal is achievable. All target setting exercises suffer from this limitation. The discussion about targets in this study is, similarly, based on the demographic goal that has been accepted.

The organisation of this report is as follows. First, an overview of the general methodology of target setting is given followed by a description of the procedures used by the family planning programme in India. Both these chapters merely provide some background information and can easily be skipped. The relationship between current

prevalence levels and targets is examined in Chapter IV with the help of the data from a target setting exercise done by the International Institute for Population Sciences (I.I.P.S.), Bombay. An attempt has been made here to look for clues on how targets should be set for sub-regions for which some information is available. For this purpose, the states in India are treated as sub-regions and the information on actual target setting in the Indian programme (as given in Chapter III) and the proposed targets (as given in Chapter IV) is used. The issue of target setting and allocation is examined in a more general manner in Chapter V with the help of a model. The conclusions are given in the last chapter.

# CHAPTER II

## THE GENERAL METHODOLOGY OF TARGET SETTING : AN OVERVIEW

A number of procedures have been proposed for target setting and computer programmes developed to facilitate the application of these. Though there are some variations in the details, the main approach of these procedures is essentially the same. This has been described below (for more information, see Dandekar, 1966; Nortman et.al., 1978; Srinivasan et.al., 1980; Bongaarts and Stover, 1986; and Ross, n.d.).

Target setting begins at a time point - the base line. Information on the demographic setting at this time is required. This includes the age-sex-marital status distribution, the level and nature of contraceptive use, and the levels of mortality and fertility. The demographic goal is usually stated in terms of a crude birth rate to be achieved by a specified date, say T years since the baseline. Since the transition from the base-level birth rate to the specified rate should be smooth, a time path of the birth rate for the interval (0, T) is then obtained. This path could be linear or non-linear depending on whether the decline in the birth rate is desired (or expected) to be constant over time, accelerating, or decelerating. The demographic goal is thus re-expressed in the form of a

series of birth rates over the interval (O, T). The population is projected over this interval based on some assumptions about the level of mortality. An assumed trend in proportion married then provides the number of married women at different time points. From these figures, and the marital fertility in the absence of contraception, the expected number of births are computed. The difference between these births and the targetted births gives the number of births to be averted. The number of effective users or couples protected is then computed using the potential fertility of contraceptive acceptors. Since the number of couples protected at a time point depends on past and new acceptors and the appropriate adjustments for death, discontinuation, and ageing of acceptors, if the number of past acceptors are known, and probabilities of ageing, death, discontinuation are available, a solution for new acceptors needed can be obtained. This, then, gives the targets required to reach the demographic goal.

The description given above is too brief to give the finer points of the various procedures or to give the variations. First, the variations. Some procedures allow the goal to be stated in terms of the net reproduction rate, the total fertility rate, or the contraceptive practice. Given information on mortality, the pattern of fertility, fertility in the absence of contraception, and age-marital

status distribution, it is not difficult to translate one statement about goal into another. Some methods treat the married women of reproductive age as a single pool (and thus require data only on general fertility, and overall prevalence rate at base-level) while some perform age-specific (5 year age groups) computations.

Most of the procedures allow the discontinuation and effectiveness rates of contraceptives to vary by method and in some cases, by age of user. Abortions are either explicitly included or assumed to be negligible. Some procedures take into account the overlap between post-partum infecundability and contraceptive use. Preferences for various methods are incorporated by assuming a given 'method-mix' or by providing alternate targets to correspond to alternate method-mixes. The potential fertility of contraceptive acceptors is generally taken to be higher than the general fertility because it is assumed that couples known to be sterile would not be contraceptive acceptors.

Clearly, the procedures outlined above are quite comprehensive and 'complete' in the sense that these take into account current knowledge of reproductive biology.

Naturally, the demands on data are also quite large. Following Nortman et.al. (1978), these can be classified as :

1. Demographic goal - the goal expressed in terms of a fertility or growth measure, the time by which it is to be obtained, and the path over the target period;

2. Demographic setting - population size and age distribution at the base year, age-specific proportions married and expected change over the target period, mortality schedules over the target period, age-specific fertility among married women in the absence of contraception;

3. Family planning factors - continuation and effectiveness of each method of contraception, method-mix, age-specific potential fertility of users had they not used a method, base-level contraceptive use, and overlap between contraceptive use and post-partum anovulation.

Information on all the points mentioned above is rarely available. However, that need not be a serious obstacle because good guesses on some of the factors would be adequate.

These procedures are generally used for setting national acceptor targets. These can also be used for large sub-national regions such as large states, provinces,

or groups of these. Often, there are large variations in the levels of development as well as marriage and breastfeeding practices in regions within a country which call for variations in demographic goals and consequently independent target setting. Fairly reliable data on the desired parameters are often available for such regions making it possible to do so. For example, Srinivasan et.al., (1980) have set targets for the major states of India using an alternate procedure of the type described above. However, the procedures appear too cumbersome to be used individually for smaller regions (say districts or blocks). Data on many of the parameters are not available for very small regions. Besides, the application of the procedures for many such regions would amount to a very laborious and expensive task. The general practice has been to allocate targets to small sub-regions on a pro-rata basis.

# CHAPTER III

## TARGET SETTING IN THE INDIAN FAMILY PLANNING PROGRAMME

Since population was recognised as an important factor in the planning process, demographic goals were also set as part of the overall plan goals. The goals were expressed in terms of levels of birth and death rates to be achieved (more specifically, to reduce the rates of fertility and mortality to the desired level) by a specified date. Along with other developmental programmes, performance targets that would achieve the desired goals were given to programme administrators. The family planning target setting is a part of this process.

Though the Government of India introduced the family planning programme in 1952, during the early phase the emphasis was on creating awareness about the methods of birth control, and providing services through clinics. The extension approach was adopted later, in the mid-sixties, and the family planning workers began door to door canvassing to motivate couples to accept birth control. Soon the target setting exercise began for the family planning programme. Initially, the targets were set in an ad-hoc manner. However, since 1969, the beginning of the fourth five year plan, the targets have been set on a scientific basis after first specifying a goal in terms of the level of fertility.

An important feature of the Indian family planning programme is the cafeteria approach, i.e., the availability of various methods of birth control from amongst which a couple can choose any. Therefore, targets are also specified by method. The methods are : sterilization (male or female), Intra-Uterine Device (IUD), and Conventional Contraceptives (CC). Though the conventional contraceptives include diaphragm, jelly etc., the principal use is of condom. More recently, oral pills are also being distributed and the targets specified separately, or along with conventional contraceptives, under 'other methods'. Medical termination of pregnancy, i.e., induced abortion performed by trained personnel, is used mainly as a health, rather than birth control, measure and hence no targets are prescribed for it. For conventional contraceptives, as well as oral pills, the targets are given in terms of number of users (more correctly person years of use) instead of number of acceptors. In practice, the person years of use is converted into the number of pieces of condom/oral pill cycles to be distributed based on some assumptions about the number of pieces etc. required for one year of use. The targets as well as actual numbers of acceptors for the plan periods beginning with the fourth plan, when the target setting began in a systematic manner, are briefly described below. Most of the discussion is

based on a background note prepared by the Department of Family Welfare, Government of India(India a).

The goal in the fourth five year plan (1969-74) was to lower the crude birth rate to 32 per thousand by the end of the plan period. The targets for contraceptive acceptance were prepared for the entire plan period and distributed over the five years in a manner such that there was a gradual increase in annual targets. The targets for the plan period and the performance are given in Table III.1. It can be seen that the performance was well below the prescribed target for each of the three method-categories.

In the fifth five year plan (1974-79) the goal was to reduce the birth rate to 30 per thousand by 1979. The target set for sterilizations was higher than the fourth plan target. However, the targets for IUD and other methods were slightly lower. The acceptance of these methods during the fourth plan period was much below the target - less than one-third of the targetted figure - and this probably led to the marginal downward adjustment of targets for the fifth plan period. On the other hand, the acceptance of sterilizations during the fourth plan period, though below the targetted level of 15 million, was not as low as the acceptance of other methods and hence

Table III.1 : Family Planning Targets and Performance in India

| Period | Demographic goal | Target (in millions) | | | Performance (in millions) | | |
|---|---|---|---|---|---|---|---|
| | | Sterilisation | IUD | Other Methods | Sterilisation | IUD | Other Methods |
| 1969-74 | CBR of 32 by 1973-74 | 15.0 (5.4) | 6.6 (2.4) | 10.4 (17.9) | 9.00 (3.2) | 2.15 (0.8) | 3.01 (5.2) |
| 1974-79 | CBR of 30 by 1978-79 | 18.5 (6.0) | 5.7 (1.8) | 10.0 (15.4) | 14.71 (4.7) | 2.50 (0.8) | 3.47 (5.4) |
| 1974-78[1] | " | 13.5 (5.5) | 4.1 (1.3) | 9.0 (14.2) | 13.23 (5.4) | 1.95 (0.8) | 3.25 (5.1) |
| 1978-79[1] | CBR of 30 by 1982-83 | 4.0 (6.2) | 0.6 (0.9) | 4.0 (6.2) | 1.48 (2.3) | 0.55 (0.8) | 3.47 (5.4) |
| 1979-80 | " | 3.1 (4.7) | 1.2 (1.8) | 5.5 (8.3) | 1.78 (2.7) | 0.64 (1.0) | 3.07 (4.6) |
| 1980-85 | CPR of 36.6% by 1984-85 | 22.0 (6.2) | 7.9 (2.2) | 11.0 (14.8) | 17.43 (4.9) | 7.17 (2.0) | 9.81 (13.2) |
| 1985-90 | CBR of 27 and CPR of 42% by 1989-90 | 31.0 (7.8) | 21.3 (5.4) | 14.5 (17.5) | - | - | - |

Note: Figures in parantheses are targets/performances per 1000 population per year.

The targets and performances for sterilisation and IUD are for the entire specified period. For the other methods, i.e., conventional contraceptives and oral pills, these refer to the number of users in the last year of the period.

1. Targets were initially proposed for the entire five year period 1974-79, but these were discontinued in 1978 and a different set of targets was given for 1978-79. Therefore, the 1974-78 portion of the original targets and the later 1978-79 targets are given separately.

CBR : Crude Birth Rate per 1000 population,
CPR : Couple Protection Rate, i.e., couples effectively protected by contraception as per cent of married couples of reproductive age.

Source: Department of Family Welfare, Government of India, (India, a).

there was an upward revision of targets. Thus, it appears that the information on the past performance was used principally to decide the relative shares of various methods.

Before the end of the fifth plan period, a change in the government took place and with it a change in the family planning programme. First, there was a change in terminology - the targets were relabelled as guidelines. Later, beginning 1978, the targets (or guidelines) were also revised. During the truncated fifth plan period, there was an intensive drive in family planning during 1976-77 which contributed to a large number of sterilizations with the result that the sterilization performance during 1974-78 almost matched the target. However, the acceptance of the IUD and the use of other methods again fell well short of the targets. The impact of the family planning programme was not as much as was expected and the goal of lowering the birth rate to 30 per thousand by 1978-79 could not be achieved. Therefore, it was proposed that this goal be achieved at least by 1982-83. For 1978-79, the targets that were set earlier were revised downwards; there was not much change in the case of sterilization but a large reduction in the targets for temporary methods (IUD and other). However, during that

year, the acceptance of sterilizations was relatively low (about 1.48 million against a target of 4 million) whereas the acceptance of IUD was better (.55 million against a target of 0.6 million) and use of other methods was also satisfactory (3.47 million, when the target was 4 million). This is reflected in the adjustment of targets for the next year, i.e., 1979-80. The sterilization target was lowered and the targets for the temporary methods were raised.

In the sixth plan period (1980-85), the goal set was a couple protection rate of 36.6 per cent by the end of the plan. The long term goal was to reach the replacement level by the year 2001. The targets proposed for the plan period were only marginally higher than the targets for the fifth plan period. The achievement was very impressive. Though the acceptance did not reach the target, it was fairly close to the target. The Seventh Plan (1985-90) goal is to reach a protection rate of 42 per cent and CBR of 27 by the end of the period. The targets have been raised considerably for this purpose. The rise is more in the case of the IUD, which reflects, partly, the greater emphasis placed on spacing methods, as well as the satisfactory level of acceptance of this method during the previous period. Rather inexplicably, however, the target for other temporary methods has not been raised significantly.

The target setting, thus, appears to have been influenced by the demographic goal as well as the past acceptance level, but the roles of these have not been clearly specified. Their relative importance also appears to be changing over time. The demographic goal has, certainly, played an important role in the setting of targets. On occasions, due to poor performance in a year, some downward revision of targets has taken place. But more appropriately, with the non-achievement of targets, the demographic goal was toned down, either explicitly or implicitly, and new targets proposed. To some extent, the past performance has guided the method-mix to be adopted in the targets. Once again, there has been no rigid rule nor consistency in this. Thus, the target setting can be said to have been broadly guided by the demographic goal and the acceptance levels in the immediate past, but not completely determined by these. Some adjustments have been made in the targets, both in the numbers as well as in the distribution over methods of contraception, and though these may not be capricious, nor have these been explicitly justified.

The targets set at the national level are split into targets for the states and union territories. In the case of conventional contraceptives, which are distributed free of cost through the network of health centres

as well as distributed through commercial channels, only the free distribution quota is split into states/territories. The procedure of apportioning the national acceptance targets to states has varied over time.

Up to 1975, the procedure of allocation of targets changed practically every year. In some years, the past performance, additional inputs envisaged, and population size determined the targets. In some other years, only the acceptance level (per 1000 population) in the district of the state that had shown high acceptance in the previous year, or the average of high and medium performance districts was used as the target for the entire state. In 1975, a formula was proposed to allocate targets to states in a more systematic manner. This formula was based on weightages to rural and urban population sizes, expenditure on family planning during the previous year, number of literate women, state income as well as gap between the actual prevalence level and the desired level. The weights to rural and urban populations were in the proportion 24 : 16, which gives the urban population a weight relatively higher than its share in the total population. Thus, states with a greater level of urbanization, higher female literacy, and higher income level were given proportionately higher targets. This could be

justified on the grounds that urbanization, education and income are expected to positively influence the demand for birth control and, therefore, states that are favourably placed in terms of these factors are likely to have a relatively larger number of acceptors. Naturally, such a policy would have lead to widening the gaps between the prevalence levels in states (assuming that acceptance would be close to targets). However, this was sought to be offset by the weight given to the gap between actual prevalence level and the desired level. The targets during 1975-77 were based on this formula, though some ad-hoc adjustments were made in the case of some states. The formula was modified in 1977 to give greater weightage to gap between the actual and desired prevalence level, and less to expenditure on family planning thus seeking to reduce interstate variation in prevalence levels. This procedure continued, with small adjustments, to be used for the allocation of targets until 1981-82. The allocation during 1982-83 was based on the previous year's targets with adjustments based on the extent of under-achievement. During 1983-84, the targets were set in accordance with the desired level of prevalence to be reached by the end of the period. Since 1984, the allocation of targets is/being done on the basis of a number of factors such as : past acceptance levels and trends,

acceptors needed to reach a desired level, and targets proposed by the states. However, no precise formula has been given and it is not clear how much weightage is given to the various factors.

In order to see how the state targets have varied over the years, in relative terms, the obvious effect of size was first eliminated by expressing these as targets per 1000 population for each of the 17 large states (with a population 3 million or greater). States with very high (at least 25% higher than the all-India target) or very low (at least 25% lower) targets are listed in Tables III.2 - III.4. In the case of sterilization targets (Table III.2) the interstate variations appear to have been large up to 1978. However, since 1978, with the sole exception of 1984-85, most states have targets near the all-India target. On the other hand, in the cases of the temporary methods (Table III.3 and III.4) a large number of states had been given very high or low targets, except during 1977-79.

As stated earlier, efforts were made to allocate targets to states in a systematic manner. Though the procedure of allocation was often unclear, and has changed over time, it appears that two factors were taken into account : the demand for birth control (as indicated by

Table III.2 : Variations in Allocation of Sterilization Targets to States

| Year | All India Target | | For the 17 Large States | | |
|---|---|---|---|---|---|
| | Number (thousands) | Per 1000 population | Range in target (per 1000 population) | States with targets at least 25% over the all-India level | States with targets at least 25% below the all India level |
| 1974-75 | 2000 | 3.65 | 2.15-5.27 | AP, MP, TN | RJ, UP |
| 1975-76 | 2492 | 4.55 | 1.98-6.95 | AP, KR, MH, GJ | PJ, UP |
| 1976-77 | 4299 | 7.84 | 3.43-12.14 | AS, KR, MH, TN | BH, HR, PJ, UP |
| 1977-78 | 3990 | 7.28 | 4.53-10.24 | KN | HR, JK, PJ, UP |
| 1978-79 | 3965 | 7.23 | 5.04-8.12 | - | HR |
| 1979-80 | 3049 | 5.56 | 3.79-7.04 | GJ | HR |
| 1980-81 | 2896 | 5.28 | 4.13-6.50 | - | - |
| 1981-82 | 2896 | 4.23 | 3.04-5.13 | - | AS |
| 1982-83 | 4522 | 6.60 | 4.57-7.63 | - | AS |
| 1983-84 | 5900 | 8.61 | 6.28-11.23 | KN | AS |
| 1984-85 | 5823 | 8.50 | 5.34-10.77 | KN | AS, JK, PJ, UP |
| 1985-86 | 5560 | 8.12 | 4.55-9.90 | - | PJ, UP |
| 1986-87 | 6000 | 8.76 | 5.86-11.57 | AP, TN | UP |

Note: For the years up to 1980-81, the 1971 population is used as the denominator and for the later years, the 1981 population, to compute target per 1000 population.

AP : Andhra Pradesh
AS : Assam
BH : Bihar
GJ : Gujarat
HR : Haryana
HP : Himachal Pradesh
JK : Jammu & Kashmir
KN : Karnataka
KR : Kerala
MP : Madhya Pradesh
MH : Maharashtra
OR : Orissa
PJ : Punjab
RJ : Rajasthan
TN : Tamil Nadu
UP : Uttar Pradesh
WB : West Bengal

Source: Compiled from Year Books of the Department of Family Welfare, Ministry of Health and Family Planning, Government of India(India, b).

Table III.3 : Variations in Allocation of I U D Targets to States

| Year | All India Target | | For the 17 Large States | | |
|---|---|---|---|---|---|
| | Number (thousands) | Per 1000 population | Range in target (per 1000 population) | States with targets at least 25% over the all-India level | States with targets at least 25% below the all-India level |
| 1974-75 | 600 | 1.09 | 0.31-2.77 | HR, JK, MP, OR, PJ, UP | AP, AS, GJ, HP, KN, MH, WB |
| 1975-76 | 912 | 1.66 | 0.32-6.23 | HR, JK, KR, MP, PJ, UP | AP, AS, GJ, HP, KN, MH, TN, WB |
| 1976-77 | 1137 | 2.07 | 0.54-10.34 | AP, HR, JK, KR, MP, UP | AS, GJ, MH, OR, TN, WB. |
| 1977-78 | 1000 | 1.82 | 1.20-2.04 | - | HR |
| 1978-79 | 600 | 1.09 | 0.76-1.21 | - | HR |
| 1979-80 | 1149 | 2.10 | 1.23-3.60 | PJ, UP | AP, AS, BH, KR, MP, MH, WB |
| 1980-81 | 791 | 1.44 | 0.79-2.04 | KN, PJ, UP | AS, OR, WB |
| 1981-82 | 791 | 1.15 | 0.64-1.63 | KN, PJ, UP | AS, OR, WB |
| 1982-83 | 1512 | 2.21 | 1.19-3.28 | PJ, UP | AP, AS, OR, WB |
| 1983-84 | 2500 | 3.65 | 1.86-5.96 | GJ, KN, MH, PJ | AP, AS, BH, MP, RJ, WB |
| 1984-85 | 3183 | 4.64 | 1.86-9.56 | GJ, HR, KN, MH, PJ | AP, AS, JK, MP, OR, RJ, TN, WB. |
| 1985-86 | 3244 | 4.73 | 1.21-11.22 | GJ, HR, MH, UP, PJ. | AP, AS, BH, JK, RJ, WB |
| 1986-87 | 3750 | 5.47 | 1.51-14.89 | GJ, HR, HP, MH, PJ | AP, AS, BH, JK, OR, RJ, WB. |

See footnotes to Table III.2.

ble III.4 : Variations in Allocation of Targets for Other Methods to States

| ar | All India Target | | For the 17 Large States | | |
|---|---|---|---|---|---|
| | Number (thousands) | Per 1000 population | Range in target(per 1000 population) | States with targets at least 25% over the all-India level | States with targets at least 25% below the all-India level |
| 74-75 | 1750 | 3.19 | 1.28-8.45 | HR, OR, PJ | AP, AS, BH, GJ, HP JK, KN, KR, MP, TN |
| 75-76 | 2607 | 4.76 | 2.13-18.02 | HR, PJ | AP, AS, BH, HP, JK, KR, OR, TN |
| 76-77 | 3190 | 5.82 | 1.30-18.63 | GJ, HR, PJ | AP, AS, BH, HP, JK, KR, OR, TN |
| 77-78 | 3400 | 6.20 | 3.75-6.39 | - | AS, HR, |
| 78-79 | 2200 | 4.01 | 2.56-4.12 | - | HR |
| 79-80 | 2103 | 3.84 | 2.19-12.45 | GJ, HR, PJ | AP, AS, BH, KN, KR, MP, MH, OR, TN, WB |
| 80-81 | 3042 | 5.55 | 3.44-9.70 | GJ, HR, MP, PJ | AS, HP, KR, MH, OR, RJ, TN. |
| 81-82 | 3042 | 4.44 | 2.62-7.54 | GJ, HR, MP, PJ | AS, HP, KR, MH, OR, RJ, TN. |
| 82-83 | 3502 | 5.11 | 2.92-9.44 | GJ, HR, PJ | AS, BH, HP, KN, OR, RJ, TN, WB. |
| 83-84 | 4000 | 5.84 | 2.00-13.85 | GJ, HR, PJ | AS, BH, JK, OR, RJ, UP |
| 84-85 | 5500 | 8.03 | 2.51-27.08 | GJ, HR, PJ | AS, BH, JK, KN, RJ, TN, UP, WB. |
| 85-86 | 4515 | 6.59 | 2.01-27.08 | GJ, HR, MH MP, PJ | AS, BH, JK, KR, RJ, TN, WB. |
| 86-87 | 5500 | 8.03 | 1.57-36.37 | GJ, HR, MH, MP, PJ. | AS, BH, JK, KN, KR, OR, RJ, TN, WB. |

e footnotes to Table III.2.

ther Methods' include Conventional Contraceptives and Oral Pills.

e all-India target given here excludes the target for commercial stribution for which no state-wise breakdown has been specified. e total target, including that for commercial distribution was ually 1.5 to 2.0 times the size specified here.

socio-economic indicators or past acceptance) and the gap between current and desired prevalence levels. However, since these two factors are inversely related (higher the past acceptance, less will be the gap between current and desired levels) so long as the demographic goal does not vary across states, their effects seem to practically offset each other with the result that the variations in targets across states are not large. Of course, this has been observed only in the case of sterilization. But then sterilization has been the principal method of birth control in the Indian programme. In recent years, there have been conscious efforts to shift the use pattern towards temporary methods. It appears that the scope to achieve this was expected to be greater in states with high prevalence levels, and hence such states (mainly Gujarat, Haryana, Maharashtra and Punjab) were given proportionately higher targets of temporary method acceptance.

This brief review of target setting in India does not provide much assistance in making any suggestions regarding allocation of targets to states and smaller regions. The observation that sterilization targets (expressed as a ratio to the population) did not vary much across states, in spite of many changes in the allocation procedure, is not adequate to suggest that a uniform

target be proposed for all regions. One reason is that large variations have been observed in the targets for temporary methods. Moreover, it is not clear if the proposed state level targets were in conformity with the demographic goal. Had the state targets been set in a systematic manner, it would perhaps have been possible to see how allocations should be made to sub-regions. To this end, a set of state level targets has been examined in the next chapter, though these targets were not put into operation.

# CHAPTER IV

## RELATIONSHIP BETWEEN PREVALENCE LEVELS AND ACCEPTOR TARGETS

Targets would depend, logically, on a number of factors - the demographic goal, marriage pattern, breast-feeding practice, natural fertility, age distribution, and prevalence rate at the baseline. The scientific target setting procedures, described in Chapter II, do take most of these factors into account. If for sub-regions within a large region (say a country, a large state or a region), the parameters mentioned above are more or less identical, then the targets for the entire region could be allocated to these sub-regions in proportion to their populations. Generally, the demographic goal is common to all the sub-regions (in fact, normally it would have been specified only for the country or state as a whole and not separately for the sub-regions). Besides, marriage patterns, breast-feeding practices, natural fertility, and age distributions would not, probably, vary much across sub-regions (though they could vary considerably across states in a large country like India or across regions in some states). However, in countries passing through the demographic transition, there could be large variations in contraceptive prevalence rates. Such variations can be observed across states in India, as well as across districts in many states. For example, among the large Indian states, the

prevalence rates in March 1985 ranged between 17.1 per cent (Uttar Pradesh) and 51.8 per cent (Maharashtra). Large variations across districts can also be observed in a number of states (Table IV.1). In the presence of such large variations, it would be useful to know whether targets should be allocated to sub-regions in proportion to population or there is a need to make adjustments in the targets according to the current prevalence levels.

In what manner does the current prevalence level affect targets? From one angle, lower the initial prevalence level, higher should the target be to raise the level. On the other hand, at high prevalence levels, attrition among current users would also be high and hence more acceptors would be needed to make-up this loss. The direction of the effect of initial prevalence level on targets is thus unclear (Fig. IV.1). An attempt is made here, therefore, to examine the relationship between current prevalence level and targets in a quasi-empirical manner.

Srinivasan et.al., (1980) prepared a series of targets for 17 large Indian states for the period 1980-2001. A common ultimate demographic goal, namely the net reproduction rate should reach a level of one, was assumed.

Table IV.1 : Variations in Couple Protection Rates Among Districts of Major States in India

| State* | Couple Protection Rate in March 1985 | | |
|---|---|---|---|
| | Entire State | Lowest (District) | Highest (District) |
| Andhra Pradesh | 32.0 | 20.1(Adilabad) | 44.5(W Godavari) |
| Bihar | 17.2 | 11.6(Sitamarhi) | 26.8(Dhanbad) |
| Gujarat | 43.5 | 30.9(Banaskantha) | 67.6(Bharuch) |
| Haryana | 45.8 | 40.0(Sonipat) | 54.9(Sirsa) |
| Karnataka | 32.8 | 23.3(Gulbarga) | 43.5(Mandya) |
| Kerala** | 38.1 | 22.9(Malapuram) | 62.7(Trivandrum) |
| Madhya Pradesh | 29.5 | 14.7(Morena) | 39.1(Ratlam) |
| Maharashtra | 51.8 | 37.3(Ratnagiri) | 64.5(Akola) |
| Orissa | 32.8 | 26.8(Phulbani) | 47.5(Mayurbhanj) |
| Punjab | 48.9 | 42.4(Jalandhar) | 56.4(Bhatinda) |
| Rajasthan | 19.8 | 8.7(Jaisalmer) | 27.1(Ganganagar) |
| Tamil Nadu | 36.1 | 27.0(Ramanathapuram) | 58.9(Madras) |
| Uttar Pradesh | 17.1 | 10.0(Mainpuri) | 28.8(Jhansi) |
| West Bengal | 27.3 | 15.5(24 Paraganas) | 43.8(Calcutta) |

Source: Extracted from: District-wise Couple Protection Rates as on 31st March 1985, Evaluation and Intelligence Division, Ministry of Health and Family Welfare, Department of Family Welfare, Government of India, New Delhi(India, c).

Notes: * All the states with a population of 10 million or more in 1981 are included except Assam for which district-wise protection rates are not available.

** Protection rates for two newly formed districts are not considered reliable and hence are ignored.

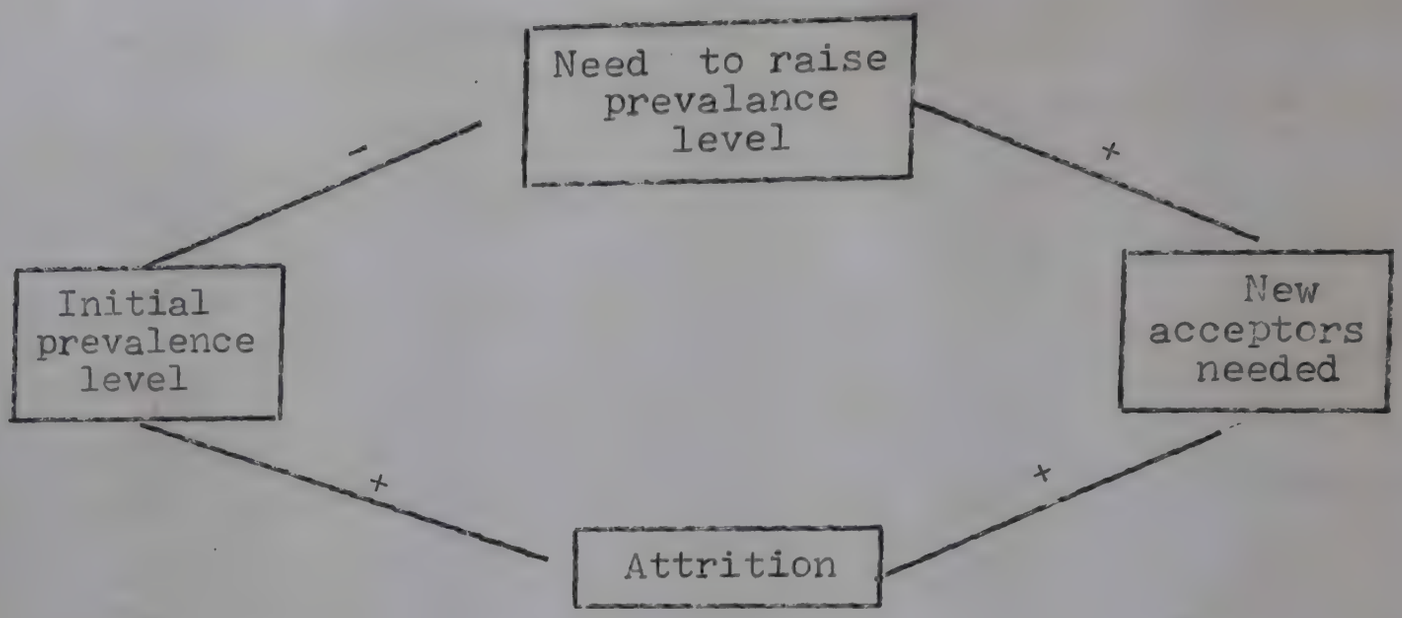


Fig. IV.1 : Effect of Initial Prevalence Level on New Acceptors Needed (Targets) to Achieve a Demographic Goal

Some states were to achieve this goal by 1991-92, some states by 1996-97 and the remaining states by 2001-02. Six alternate sets of targets are given : for three method mixes (high, medium, and low sterilization) and for each method mix, two paths to the ultimate level (linear and exponential). Base level estimates of age distribution, prevalence rate, etc. were obtained from the information available (1971 census, family planning statistics, etc.) The target setting methodology is similar to that of TABRAP. Intermediate results, in particular prevalence rates for each year up to 2001-02, are given. With the help of these results, it is possible to relate initial prevalence

levels to targets. It should be mentioned here that this target setting exercise was done before the 1981 census was conducted. In the light of the results of the census, and with updated information on family planning acceptance since then, the targets need to be updated. In fact, Srinivasan and Parasuraman (1985) have prepared such an update for India. But that does not concern us at this stage because the intention here is not to look into the relevance of the targets, but rather to examine in what manner are these affected by initial prevalence level and for this purpose the available series of targets can be used.

In Table IV.2 targets and initial prevalence rates are given for the 17 states. Instead of targets for each year, the averages for four 5 year periods; 1981-86, 1986-91, 1991-96, 1996-2001 are given alongwith the prevalence rates for 1980-81, 1985-86, 1990-91 and 1995-96, which precede the four periods given above in that order. The states are divided into three panels corresponding to the time by which the demographic goal is to be achieved: NRR of 1 in 1991-92 (7 states), in 1996-97 (6 states), and in 2001-02 (4 states). In the first panel, the prevalence rate in 1980-81 varies between 24.3 and 44.6 per cent and the annual sterilization targets for 1981-86

Table IV.2 : Sterilization Targets and Couple Protection Rates for States in India

(Based on I.I.P.S. 1980 targets, High Priority, Sterilization, Linear Path)

| State | CPR 80-81 | Ster. target 81-86 | CPR 85-86 | Ster. target 86-91 | CPR 90-91 | Ster. target 91-96 | CPR 91-96 | Ster. target 1996-2001 |
|---|---|---|---|---|---|---|---|---|
| | Panel 1 (NRR = 1 in 1991-92) | | | | | | | |
| Andhra Pradesh | 28.9 | 5.64 | 37.1 | 7.12 | 46.8 | 7.41 | 53.0 | 7.41 |
| Gujarat | 37.5 | 7.10 | 46.9 | 7.61 | 54.7 | 7.73 | 59.1 | 7.75 |
| Haryana | 44.6 | 9.15 | 50.0 | 7.24 | 56.2 | 8.12 | 61.9 | 7.81 |
| Kerala | 30.1 | 6.02 | 40.9 | 7.74 | 52.9 | 7.08 | 57.7 | 6.97 |
| Maharashtra | 39.3 | 6.13 | 46.1 | 7.04 | 52.7 | 7.47 | 57.6 | 7.29 |
| Punjab | 24.3 | 8.53 | 38.9 | 8.88 | 54.6 | 7.19 | 59.2 | 6.99 |
| Tamil Nadu | 32.6 | 6.18 | 39.8 | 7.30 | 48.3 | 7.33 | 54.4 | 7.02 |
| | Panel 2 (NRR = 1 in 1996-97) | | | | | | | |
| Assam | 20.6 | 6.06 | 33.8 | 8.06 | 48.9 | 9.74 | 65.0 | 8.25 |
| Karnataka | 24.7 | 6.23 | 34.8 | 7.26 | 44.9 | 8.05 | 55.1 | 7.61 |
| Madhya Pradesh | 23.9 | 5.54 | 31.9 | 6.90 | 41.8 | 7.68 | 52.8 | 7.22 |
| Orissa | 28.3 | 6.10 | 37.3 | 7.23 | 46.8 | 7.79 | 56.1 | 7.57 |
| West Bengal | 22.9 | 5.84 | 33.7 | 7.33 | 45.3 | 8.19 | 56.6 | 7.30 |
| Himachal Pradesh | 25.6 | 5.36 | 32.6 | 6.41 | 40.6 | 7.25 | 49.6 | 7.00 |
| | Panel 3 (NRR = 1 in 2001-02) | | | | | | | |
| Bihar | 12.9 | 4.66 | 21.68 | 6.31 | 33.0 | 7.60 | 45.7 | 8.30 |
| Jammu & Kashmir | 11.3 | 4.43 | 20.26 | 5.89 | 31.6 | 7.30 | 44.3 | 8.31 |
| Rajasthan | 14.8 | 5.07 | 23.56 | 5.99 | 33.6 | 7.05 | 44.3 | 7.89 |
| Uttar Pradesh | 12.8 | 5.35 | 21.19 | 5.94 | 31.5 | 6.80 | 42.3 | 7.28 |

NOTE: Sterilisation target is No.of sterilizations per 1000 population per year, average for the 5 year period.

CPR is per cent of MWRA protected by contraception.

between 5.64 and 9.15 per thousand population, but no clear association can be seen between the two. The targets for 1986-91 and the two subsequent periods fall in a much narrower range and again do not seem to vary by the prevalence rates in either 1980-81 or in 1985-86. Similar observations can be made about the states in the second and the third panels as well.

The targets in the three panels should not be viewed together directly since the time by which the goal of NRR of one is to be achieved is not the same in these panels. But with appropriate time displacement, the targets can be put together to have a broader base that would make it possible to examine the association between initial prevalence rates and targets in a more meaningful manner. Putting T = 1980-81 for panel 1 states, 1985-86 for panel 2 states, and 1990-91 for panel 3 states, the goal can be expressed as : to reach NRR of one in the year T + 11. The targets for the period T + 1 to T + 5 do not seem to be significantly influenced by the base level (year T) prevalence rates. Similarly targets for the period T + 6 to T + 10 do not seem to depend on the prevalence rate at the base year (T) or at the intermediate point (T + 5) (see Table IV.3). These results are based on the targets given in one of the six variants

Table IV.3 : Effect of Base-Level Prevalence Rate on Targets

| x<br>Contraceptive prevalence rate as % of MWRA in year : | y<br>Sterilization Target per year per 1000 population during : | a<br>Intercept | b<br>Slope | r<br>Correlation coefficient |
|---|---|---|---|---|
| T | T+1 to T+5 | 5.283 | 0.054 | 0.26 |
| T | T+6 to T+10 | 9.556 | -.051 | -.32 |
| T+5 | T+6 to T+10 | 5.644 | 0.050 | 0.26 |

Note: 1 The intercept and the slope are from the regression equation with sterilization target as the dependent variable and initial prevalence rate as the independent variable, computed from the data for the 17 states given in Table IV.2.

2 T = 1980-81 for states in panel 1, 1985-86 for states in panel 2, and 1990-91 for states in panel 3 of Table IV .2. The demographic goal is to reach NRR in the year T + 11.

considered, the one with high priority for sterilization and linear path to the goal. Other paths also show a similar pattern. For the purposes of illustration, prevalence rates and targets for another variant, namely the 'low priority sterilization linear path' are given in Table IV.4. Further, the targets are given for only sterilization because targets for other methods are proportionate to the sterilization targets and therefore would have identical relationships with prevalence rates.

If the targets are not, or only weakly, influenced by the initial prevalence level, does it make sense to ignore this while fixing targets? In the next chapter, an attempt is made to do precisely this and the effect on future prevalence levels is examined.

The answer to the question posed earlier, i.e., in what manner does the initial prevalence level affect targets, is that the influence of the initial level on the targets is weak and unclear. In terms of the paths shown in Fig. IV.1, the positive effect of initial prevalence level, through attrition, appears to almost balance the negative effect through the needed rise in the level. In other words, though regions with high initial prevalence level need not raise that level much and would not need many new acceptors for this purpose,

Table IV.4 : Sterilization Targets and Couple Protection Rates for States in India

(Based on I.I.P.S. 1980 Targets, 'Low Priority Ster Linear Path')

| States | CPR | Steri-lization target | CPR | Steri-lization target | CPR | Steri-lization target | CPR | Ste liz tio tar get |
|---|---|---|---|---|---|---|---|---|
| | 80-81 | 81-86 | 85-86 | 86-91 | 90-91 | 91-96 | 95-96 | 199 200 |
| | Panel 1 (NRR = 1 in 1991-92) | | | | | | | |
| Andhra Pradesh | 28.9 | 3.14 | 36.3 | 4.96 | 44.7 | 5.62 | 49.6 | 5.8 |
| Gujarat | 37.5 | 4.22 | 46.7 | 5.73 | 54.1 | 6.30 | 57.8 | 6.4 |
| Haryana | 44.6 | 5.61 | 50.0 | 5.82 | 55.4 | 6.55 | 60.4 | 6.5 |
| Kerala | 30.1 | 3.33 | 39.7 | 5.30 | 49.9 | 5.53 | 53.7 | 5.5 |
| Maharashtra | 39.3 | 3.48 | 45.4 | 5.06 | 50.6 | 5.76 | 54.2 | 5.8 |
| Punjab | 24.3 | 4.99 | 38.3 | 6.54 | 53.2 | 6.17 | 57.4 | 5.9 |
| Tamil Nadu | 32.6 | 3.44 | 38.8 | 5.04 | 45.7 | 5.57 | 50.5 | 5.5 |
| | Panel 2 (NRR = 1 in 1996-97) | | | | | | | |
| Assam | 20.6 | 3.55 | 33.8 | 5.85 | 48.7 | 7.61 | 64.7 | 7.39 |
| Karnataka | 24.7 | 3.48 | 33.8 | 5.05 | 42.6 | 6.02 | 51.7 | 6.15 |
| Madhya Pradesh | 30.1 | 3.25 | 39.7 | 5.02 | 49.9 | 5.95 | 53.7 | 5.98 |
| Orissa | 28.3 | 3.41 | 36.3 | 5.08 | 44.6 | 5.91 | 52.8 | 6.11 |
| West Bengal | 22.9 | 3.39 | 33.5 | 5.29 | 44.4 | 6.36 | 55.2 | 6.25 |
| Himachal Pradesh | 25.6 | 3.13 | 32.4 | 4.67 | 39.9 | 5.58 | 48.1 | 5.69 |
| | Panel 3 (NRR = 1 in 2001-02) | | | | | | | |
| Bihar | 12.9 | 2.71 | 21.7 | 4.48 | 32.7 | 5.69 | 44.7 | 6.50 |
| Jammu & Kashmir | 11.3 | 2.56 | 20.1 | 4.16 | 31.2 | 5.41 | 43.3 | 6.43 |
| Rajasthan | 14.8 | 2.97 | 25.4 | 4.33 | 32.9 | 5.35 | 43.2 | 6.18 |
| Uttar Pradesh | 12.8 | 3.14 | 21.1 | 4.28 | 30.8 | 5.10 | 40.8 | 5.65 |

NOTE: Sterilisation target is No.of sterilisations per 1000 population per year, average for the 5 year period.

CPR is per cent of MWRA protected by contraception.

the high prevalence implies a large number discontinuing the method as well as ageing and many new acceptors are needed to make up for this loss. By stretching this a little further, it could be argued that even a region which has reached the desired (and presumably high) level of prevalence would continue to need many new acceptors simply to maintain the attained level.

Bongaarts (1986) has given the decomposition of the target requirements into those needed (i) to raise the level of prevalence, (ii) to make up for discontinuation, and (iii) to make up for ageing, in an illustrative target setting scheme for Pakistan. This shows that initially many acceptors are needed to raise the prevalence level, and fewer to make up for losses on the account of ageing. However, as the prevalence level rises over time, more are needed to make up for the losses and fewer to raise the prevalence level (see Fig. 6 in Bongaarts, 1986). In one of the variations given by Bongaarts, when the discontinuation of contraceptives is very low, after the first few years the number of acceptors needed rises only slowly and the acceptor rate (acceptors per 1000 MWRA) remains practically constant while at the same time the prevalence level rises steadily.

Both the cross-section data culled out of the exercise for the Indian states as well as the time series of targets read from Bongaarts' results indicate that the targets are not much dependent on the initial prevalence levels. This is not an unqualified inference since the effects of other factors have not been eliminated while examining the Indian data. No proper simulation exercise has been undertaken here that would control for the effects of other factors, nor is it clear whether similar findings would be obtained had data on targets from other sources been used. Besides, Bongaarts' data only partly support the (tentative) claim made above, since in the early phase of that time series, both the acceptance and the prevalence levels are low. None the less, the observation that initial prevalence levels appear to have little influence on acceptor targets leads to the query : What would happen if targets are, in fact, set independently of initial prevalence levels ? In other words, other things being constant, if regions with low prevalence levels initially are assigned the same targets as those with high initial level, what would be the path of prevalence levels and would the regions lagging behind at the beginning be able to achieve the desired goal? And, what is the role of 'other factors' ? An attempt is made to answer these questions in the next chapter with the aid of a model.

# CHAPTER V

## A MODEL LINKING ACCEPTANCE, ATTRITION AND PREVALENCE LEVELS

The contraceptive prevalence level at a point in time depends on the past acceptance streams, attrition among users, and of course the size of the population or the number of couples of reproductive age. Therefore, given a prevalence level at an epoch, this level along with the acceptance up to a specified time, the attrition, and the growth in the number of couples of reproductive age, will determine the prevalence level at that time. In a continuous time framework, this relationship can be expressed in the form of a differential equation that aids the examination of the roles of various factors in determining the prevalence rate. Some notation is necessary.

Let,

$M(t)$ = No.of married women of reproductive age (MWRA) at time t,

$C(t)$ = No.of couples of reproductive age (i.e. with wife MWRA), protected by contraception at time t,

$\theta(t)$ = Contraceptive prevalence rate (or couple protection rate) at time t,

$a(t)$ = Acceptance rate (acceptors as proportion of MWRA) at time $t$,

$s(t)$ = Attrition rate among users at time $t$,

$r(t)$ = Growth rate of MWRA at time $t$,

$t$ = Time in years since the beginning of the programme.

Note that $a(t)$, $s(t)$, and $r(t)$ are defined as instantaneous rates, i.e. $a(t) \cdot \Delta t \cdot M(t)$ = No.of acceptors during $t$, $t + \Delta t$, etc. Further, $s(t)$ includes attrition due to ageing, dissolution, and discontinuation together. It should also be noted that $r(t)$ is the growth rate of MWRA and not necessarily that of the total population, though generally it would not be much different from the population grwoth rate and in case a population is stable, would be identical to the stable growth rate.

The acceptance rate $a(t)$ is expressed here as a proportion of <u>all</u> MWRA at time $t$, including the users and non-users and not as a proportion of non-users as is done in many exercises. It follows that

$$r(t) = \frac{1}{M(t)} \frac{dM(t)}{dt}; \quad \text{and}$$

$$\theta(t) = C(t)/M(t)$$

Further,

$C(t + \Delta t)$ = Users at time $t + \Delta t$

= Users at time t+ Acceptors during $(t, t+ \Delta t)$

- Attrition during $(t, t+ \Delta t)$

$$= C(t) + a(t)\, M(t)\, \Delta t - s(t)\, C(t)\, \Delta t \quad \ldots \quad (V.1)$$

Therefore

$$\frac{d\,C\,(t)}{dt} = a\,(t)\,M\,(t) - s(t)\,C\,(t)$$

Now, since $\theta\,(t) = C\,(t)/M\,(t)$,

$$\frac{d}{dt}\,\theta\,(t) = \frac{1}{M\,(t)}\frac{d}{dt}C(t) - \frac{C\,(t)}{M^2(t)}\,\frac{d}{dt}\,(M\,(t))$$

$$= \frac{1}{M\,(t)}\,(a\,(t)\,M\,(t) - s\,(t)\,C\,(t))$$

$$- \frac{C\,(t)}{M^2(t)}\,(r\,(t)\,M\,(t))$$

$$= a(t) - s(t)\,C(t)/M(t) - r(t)\,C(t)/M\,(t)$$

$$= a\,(t) - \frac{C\,(t)}{M\,(t)}\,(s\,(t) + r\,(t))$$

$$= a\,(t) - \theta\,(t)\,(s\,(t) + r\,(t)) \quad \ldots \quad \ldots \quad (V.2)$$

If the acceptance rate a (t) equals $\theta\,(t)\,(s\,(t) + r\,(t))$ then $\frac{d}{dt}\,\theta\,(t)$ will equal 0 and $\theta\,(t)$ will remain unchanged.

The acceptance, in this case, exactly balances attrition: $s(t)$, and the growth in MWRA : $r(t)$, scaled by the prevalence rate $\theta(t)$, and thus keeps $\theta(t)$ constant, say $\theta_1$.

If method-mix, and discontinuation rates and age distribution of users do not change, $s(t)$ will also converge to a value, say $s_1$, as $t \to \infty$. Moreover, if mortality and fertility of non-users also does not change, a constant $\theta(t)$ will lead to a stable population, and hence $r(t) \to r_1$ (say), as $t \to \infty$.

Consequently,

$$a(t) = \theta(t)\,(s(t) + r(t))$$

$$\to \theta_1\,(s_1 + r_1) \text{ as } t \to \infty.$$

Thus, in the long run, the population will need a constant acceptance rate $\theta_1\,(s_1 + r_1)$ to maintain a prevalence rate of $\theta_1$. The population then can be considered to be in a state of equilibrium with respect to the prevalence rate.

Now, suppose, the goal is to reach a prevalence rate of $\theta_1$ in the long run. Further, the initial prevalence level is $\theta(0)$ $(= \theta_0$, say) which may equal 0 (no use at the beginning of the programme) or be higher.

Let the acceptor target after time 0, prescribed in terms of acceptance rate a (t), be

$$a(t) = \theta_1 (s(t) + r(t)) \quad \ldots \quad \ldots \quad (V.3)$$

This formulation presupposes that $s(t) + r(t) \geq 0$, otherwise the acceptance rate would be meaningless. This condition would almost always be satisfied since $s(t) \geq 0$, and generally $r(t) \geq 0$; and even if r (t) is negative, it would rarely be large enough to make s (t) + r(t) negative. Substituting a (t) in eq. (V.2),

$$\frac{d}{dt}\theta(t) = \theta_1 (s(t) + r(t)) - \theta(t) (s(t) + r(t))$$

$$= (\theta_1 - \theta(t)) (s(t) + r(t)).$$

Solving,

$$-\ln(\theta_1 - \theta(t)) = \int_0^t (s(u) + r(u))\, du - \ln(\theta_1 - \theta_0),$$

which gives

$$\theta(t) = \theta_1 - (\theta_1 - \theta_0)\, e^{-\int_0^t (s(u) + r(u))\, du} \quad \ldots (V.4)$$

As $t \to \infty$, $\theta(t) \to \theta_1$

provided the integral $\int_0^t (s(u) + r(u))\, du \to \infty$ as $t \to \infty$. The attrition rate s(u) could vary a little with u, but even in the case of sterilization which faces

no risk of discontinuation, the attrition rate would be around .05 and since r(u) would be positive or near zero, $\int_0^t (s(u) + r(u))\, du \to \infty$ as $t \to \infty$ and hence $\theta(t) \to \theta_1$.

Thus, the acceptor target specified in eq.(V.3) would ultimately lead to a prevalence rate of $\theta_1$. The important question then is; how rapid is the convergence to $\theta_1$ ? From eq. (V.4) it can be seen that the convergence would be rapid if s(u) + r(u) is large. Note that the acceptor target is proportional to the goal of prevalence ($\theta_1$) and sum of the attrition rate and the growth rate, but does not explicitly include the initial prevalence level $\theta_o$. The attrition and the growth rates could, to a certain extent, depend on the current prevalence rates, and hence on $\theta_o$ at least in the early period of the programme. The profile of users at low levels of prevalence could be different from that at higher levels. Besides, the growth rate would be higher initially, falling slowly as the prevalence level rises (assuming, of course, that the initial prevalence level $\theta_o$ is not higher than the desired level of $\theta_1$).

In order to see how rapidly would $\theta$ (t) converge to $\theta_1$, some simplifying assumptions need to be made about the paths of s(u) and r(u). First, since s(u) is

heavily influenced by the method-mix, as long as the method-mix remains fairly constant, s(u) will not change much, since of the other factors influencing s(u), mortality is assumed to remain constant, and minor changes in the age distribution of users will have only a small effect on s(u). Thus s(u) may be assumed to be constant. If the population is stable initially, r(u) will remain constant and equal to $r_o$ for $0 \leq u < \alpha$, where $\alpha$ is the minimum age at child bearing, since r(u) here refers to the growth rate of MWRA. Stretching this a little further, r(u) can be assumed to be constant($=r_o$) during $0 \leq u \leq A$, where A is the age below which a substantial number of births do not take place, e.g., if most women marry at an age near or over 20, A can be assumed to be 20. Beyond A, r(u) would decline gradually to $r_1$ since the number of women entering the pool of MWRA would have been affected by the contraceptive practice after time 0. Two paths of such a decline are assumed:

i) a linear path; in which r(u) declines from $r_o$ at time A to $r_1$ linearly over the next B years, i.e.,

$$r(u) = \begin{cases} r_o, & 0 \leq u \leq A, \\ r_o \frac{(A+B-u)}{B} + r_1 \left(\frac{u-A}{B}\right), & A < u \leq A+B, \\ r_1, & u > A+B \end{cases} \quad \ldots \text{(V.5)}$$

ii) an exponential path, in which $r(u)$ declines from $r_o$ at time A at an exponential rate of k to $r_1$ as $t \to \infty$ ,

$$r(u) = \begin{cases} r_o, & 0 \leq u \leq A, \\ (r_o - r_1)\, e^{-k(u-A)} + r_1, & u > A \end{cases} \quad \ldots \text{(V.6)}$$

With constant attrition rate $s_1$ and a linear change in $r(u)$, eq. (V.4) can be written as:

$$\theta(t) = \begin{cases} \theta_1 - (\theta_1 - \theta_o)\, e^{-(s_1 + r_o)\, t}, & 0 \leq t \leq A, \\ \theta_1 - (\theta_1 - \theta_o) e^{-s_1 t - r_o \left(A + \frac{B}{2} - \frac{(A+B-t)^2}{2B}\right) - r_1 \frac{(t-A)^2}{2B}}, & A < t \leq A+B, \\ \theta_1 - (\theta_1 - \theta_o) e^{-s_1 t - r_o \left(A+\frac{B}{2}\right) - r_1 \left(t - A - \frac{B}{2}\right)}, & t > A+B \end{cases} \quad \ldots \text{(V.7)}$$

Furthermore, if the goal is to ultimately reach a stationery level; $r_1 = 0$, and eq.(V.7) simplifies considerably. Also, the acceptor targets a (t) can then be written as:

$$a(t) = \theta_1 (s(t) + r(t))$$

$$= \begin{cases} \theta_1 (s_1 + r_o), & 0 \leq t \leq A, \\ \theta_1 (s_1 + r_o (A+B-t)/B), & A \leq t \leq A + B, \\ \theta_1 s_1, & t > A + B. \end{cases} \quad \ldots (V.8)$$

Thus, it can be seen that in this case the acceptor target would be $\theta_1 s_1$ in the long run, and only slightly higher, $\theta_1 (s_1 + r_o)$, initially, gradually reducing to $\theta_1 s_1$.

If the change in r(u) is exponential and s(u) is constant $(=s_1)$, eq. (V.4) can be written as

$$\theta(t) = \begin{cases} \theta_1 - (\theta_1 - \theta_o) e^{-(s_1 + r_o) t}, \\ \qquad\qquad 0 \leq t \leq A, \\ \theta_1 - (\theta_1 - \theta_o) e^{-s_1 t} - r_o A - r_1 (t-A) - \dfrac{(r_o - r_1)}{k} (1 - e^{-k(t-A)}), \\ \qquad\qquad A < t, \end{cases} \quad \ldots (V.9)$$

which also simplifies if $r_1 = 0$, and in that case the acceptor target can be given as:

$$a(t) = \begin{cases} \theta_1 (s_1 + r_o), & 0 \leq t \leq A, \\ \theta_1 (s_1 + r_o e^{-k(t-A)}), & A < t \end{cases} \quad \ldots (V.10)$$

In the long run, $e^{-k(t-A)} \to 0$ and hence a(t) will equal $\theta_1 s_1$. Thus, regardless of the path of decline, the rate of acceptance will initially be $\theta_1 (s_1 + r_o)$ and gradually fall to $\theta_1 s_1$ if the goal is to reach replacement level fertility, and fall to $\theta_1 (s_1 + r_1)$ if the goal is to reach a growth rate of $r_1$.

In order to examine the path of change in $\theta(t)$ over time, the values were computed for various levels of initial prevalence rate ($\theta_o$ = .0, .1, .2, .3, .4), levels of attrition ($s_1$ = .05, .08, .1, .2), initial growth rate ($r_o$ = .01, .02, .03), and for A = 20, B = 70 (for the linear path), and k = .05 (for the exponential path). The ranges of trial values are wide enough to encompass most real situations. Initial prevalence level may be zero - no contraception - or higher; values beyond .4 (or 40 per cent prevalence) are not considered because these would be too close to the desired level so that the convergence would be rapid anyway. Attrition would be low in the case of sterilization, near 5 per cent (hence $s_1$ = .05), and high in the case of temporary

methods. For the present method-mix in India, the attrition level is near 12 per cent, if the use of conventional contraceptives is ignored. For high values of $s_1$, as noted earlier, the convergence would be much more rapid and hence no computations have been performed beyond $s_1 = .2$. The reason for using a value of 20 for A has already been given. If by the end of this 20 year period the prevalence rate $\theta$ (t) is close enough to $\theta_1$, the net reproduction rate would be close to 1; however, r (t) will not equal 0 since some time would be required for the population to restabilise. Some exercises have shown that it takes about 50-80 years for the growth rate to reach a level very near the new stable rate (0 in this case). Therefore, B is taken to be 70. Similarly, a value of .05 for k would bring r(t) near 0 in about 70 years, and hence this value is chosen. Two values are used for the ultimate prevalence level : .60, or 60 per cent, which corresponds to the goal of net reproduction rate of 1 in the Indian programme, and a higher value of 70 per cent.

Some of the results are given in Tables V.1 - V.4. The path of the prevalence level $\theta$ (t) over a 30 year period is given in Table V.1 for a range of initial prevalence levels. The attrition rate is held constant at 10 per cent and the initial growth rate is assumed to be 2 per

Table V.1 : Paths of Contraceptive Prevalence Rates and Acceptance Rates for Varying Initial Prevalence Levels

| Initial prevalence (per cent) | | Time (in years since the beginning) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 15 | 20 | 25 | 30 |
| | | Prevalence Rate (per cent) | | | | | |
| | I | (Desired Level of Prevalence: 60 per cent) | | | | | |
| 0 | | 27.1 | 41.9 | 50.1 | 54.6 | 57.0 | 58.3 |
| 20 | | 38.0 | 48.0 | 53.4 | 56.4 | 58.0 | 58.9 |
| 40 | | 49.0 | 54.0 | 56.7 | 58.2 | 59.0 | 59.4 |
| | | (7.2) | (7.2) | (7.2) | (7.2) | (7.1) | (7.0) |
| | II | (Desired Level of Prevalence: 70 percent) | | | | | |
| 0 | | 31.6 | 48.9 | 58.4 | 63.6 | 66.5 | 68.1 |
| 20 | | 42.6 | 54.9 | 61.7 | 65.5 | 67.5 | 68.6 |
| 40 | | 53.5 | 61.0 | 65.0 | 67.3 | 68.5 | 69.2 |
| | | (8.4) | (8.4) | (8.4) | (8.4) | (8.3) | (8.2) |

Note: Figures in parantheses are acceptance rates per 100 couples of reproductive age, per annum.

Constant parameters: Attrition rate = 10 per cent, initial growth rate = 2 per cent, and linear decline in growth rate with A = 20 years, B = 70 years.

Table V.2 : Paths of Contraceptive Prevalence Rates and Acceptance Rates for Varying Attrition Levels

| Attrition rate (per cent) | Time (in years since the beginning) 10 | 20 | 30 |
|---|---|---|---|
| | Prevalence Rate (per cent) | | |
| 5 | 40.1 (4.2) | 50.1 (4.2) | 55.0 (4.0) |
| 10 | 48.0 (7.2) | 56.4 (7.2) | 58.9 (7.0) |
| 20 | 55.6 (13.2) | 59.5 (13.2) | 59.9 (13.0) |

Note: Figures in parantheses are acceptance rates.

Constant parameters: Desired level of prevalence = 60 per cent, initial prevalence level = 20 per cent, initial growth rate = 2 per cent, linear decline in growth rate with A = 20 years, B = 70 years.

Table V.3 : Paths of Contraceptive Prevalence Rates and Acceptance Rates for Varying Initial Growth Rates

| Initial Growth rate (Per cent) | (in years since the beginning) Time 10 | 20 | 30 |
|---|---|---|---|
| | Prevalence Rate (per cent) | | |
| | I (Attrition rate = 5 per cent) | | |
| 1 | 38.0 (3.6) | 48.0 (3.6) | 53.3 (3.5) |
| 2 | 40.1 (4.2) | 50.1 (4.2) | 55.0 (4.0) |
| 3 | 42.0 (4.8) | 51.9 (4.8) | 56.3 (4.5) |
| | II (Attrition rate = 10 per cent) | | |
| 1 | 46.7 (6.6) | 55.6 (6.6) | 58.5 (6.5) |
| 2 | 48.0 (7.2) | 56.4 (7.2) | 58.9 (7.0) |
| 3 | 49.1 (7.8) | 57.0 (7.8) | 59.2 (7.5) |

NOTE: Figures in parantheses are acceptance rates.

Constant parameters: Desired level of prevalence = 60 per cent, initial prevalence level = 20 per cent, linear decline in growth rate, A = 20 years, B = 70 years.

Table V.4 : Paths of Contraceptive Prevalence Rates and Acceptance Rates for Various Types of Declines in Growth Rates

| Type of decline in growth rate | Time (in years since the beginning) | | |
|---|---|---|---|
| | 10 | 20 | 30 |
| | Prevalence Rate (per cent) | | |
| Linear (A=0, B=70) | 47.8 (7.0) | 56.2 (6.9) | 58.8 (6.7) |
| Linear (A=10, B=70) | 48.0 (7.2) | 56.3 (7.0) | 58.8 (6.9) |
| Linear (A=20, B=70) | 48.0 (7.2) | 56.4 (7.2) | 58.9 (7.0) |
| Linear (A=20, B=50) | 48.0 (7.2) | 56.4 (7.2) | 58.9 (7.0) |
| Linear (A=20, B=90) | 48.0 (7.2) | 56.4 (7.2) | 58.9 (7.1) |
| Exponential (A=20, K=.05) | 48.0 (7.2) | 56.4 (7.2) | 58.9 (6.7) |

NOTE: Figures in parantheses are acceptance rates.

Constant parameters: Desired level of prevalence = 60 per cent, initial level of prevalence = 20 per cent, attrition rate = 10 per cent, growth rate = 2 per cent.

cent with a linear decline in it. It can be seen that the rise in the prevalence level is quite rapid and by 20 years, the level gets very close (within 10 per cent) to the desired level, even when the initial level, $\theta_o$, is very low.* In Table V.2 the attrition rate is varied keeping the initial level at 20 per cent. As expected, the convergence is rapid if the attrition level is high. Naturally, the required rate of acceptance must also be high in such a situation. The impact of other factors - the initial growth rate and the nature of decline in it - can be examined with the help of Tables V.3 - V.4. Higher the initial growth rate, more rapid is the convergence of $\theta$ (t). The nature of decline in the growth rate over time, whether it is linear or exponential and whether it is small or large, appears to play a very minor role in the rate of convergence.

These tables are illustrative, but the variation in the parameters is adequate to make some inferences about the time path of contraceptive prevalance in a population subjected to a series of acceptance rates. First, the prevalance level converges quite rapidly to the desired level in all the cases examined. A period of about 20 years is long enough for a population with low initial prevalence to catch up with another with high

* Also see Fig. V.1 and V.2.

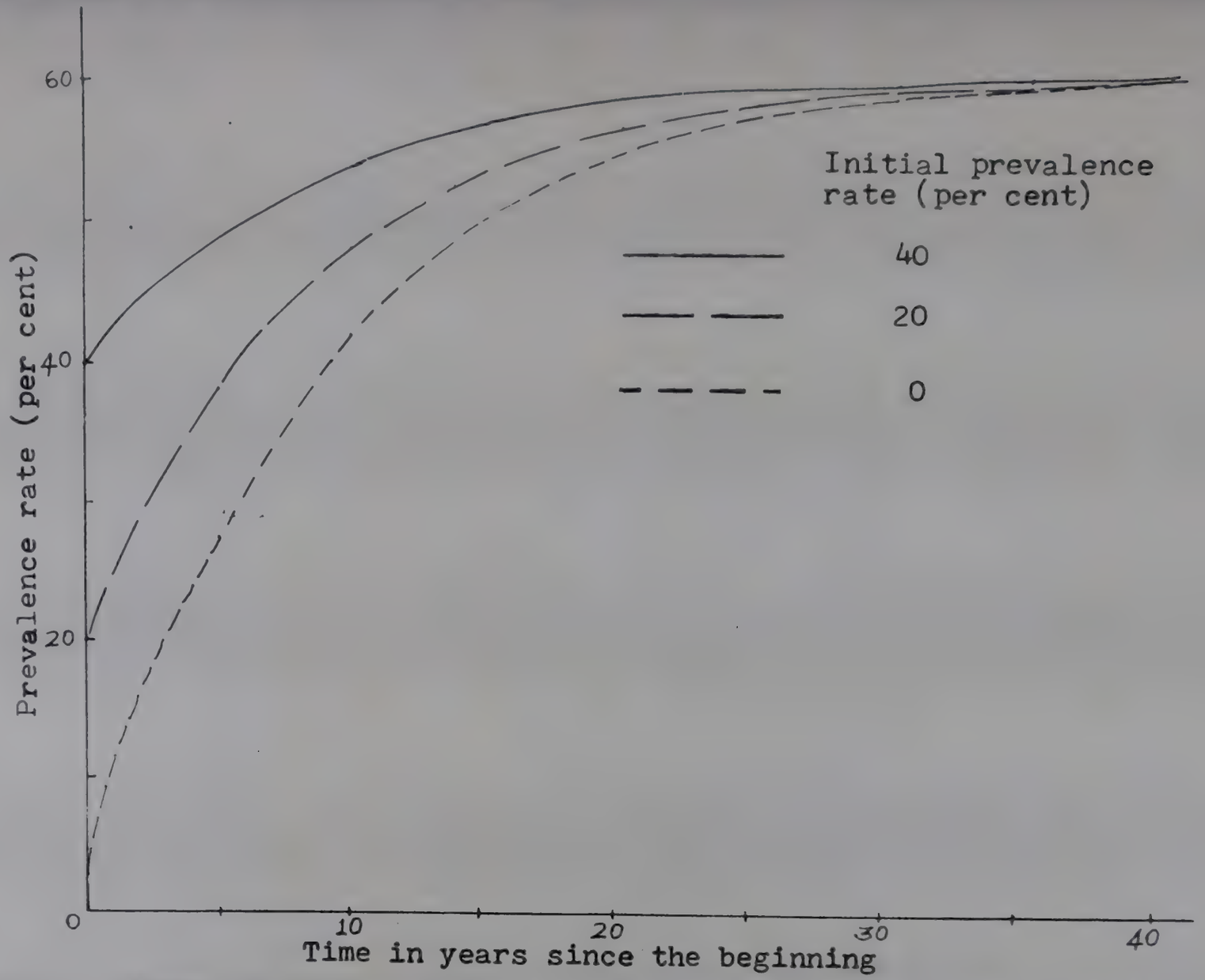


Fig.V.1 Paths of Contraceptive prevalence rates for various initial prevalence levels (constant parameters : desired prevalence level = 60%, attrition rate = 10%, initial growth rate = 2%, linear decline in growth rate).

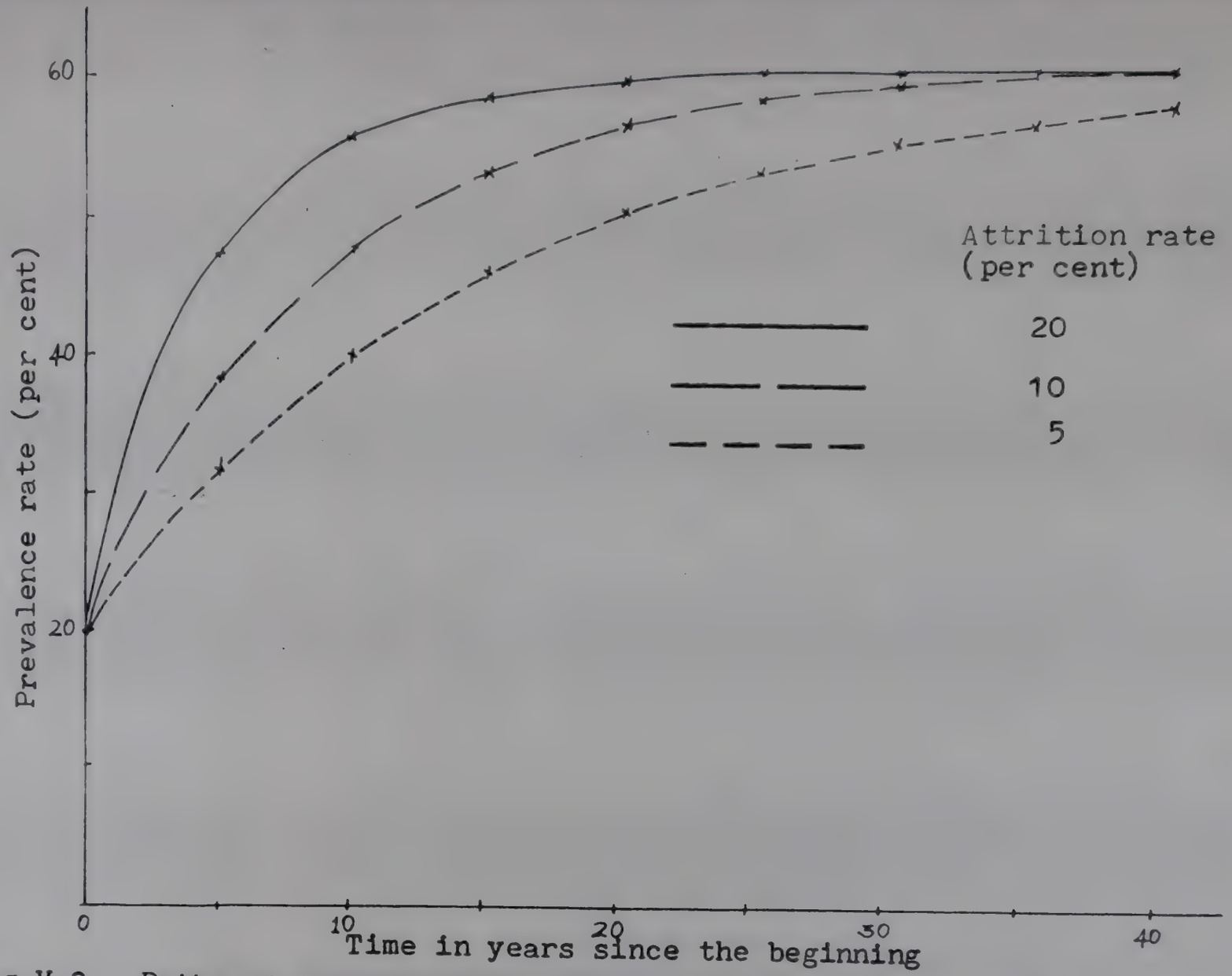


Fig.V.2 Paths of Contraceptive prevalence rates for various attrition rates (constant parameters : desired prevalence level = 60%, initial prevalence level = 20%, initial growth rate = 2%, linear decline in growth rate).

initial prevalence, even when both are subjected to an identical acceptance rate. This result holds even when some of the other parameters are varied within a plausible range. Translated into target terminology, if sub-regions with vastly varying initial prevalence level are subjected to identical acceptance rates (relative to the size of the couples of reproductive age), the prevalence levels in these sub-regions would soon converge. Therefore, if the time by which a demographic goal is to be achieved is long enough, say 20 years, the targets need not depend upon the initial prevalence level. And even if the programme duration is somewhat shorter than 20 years, identical acceptance rate targets would considerably narrow down the gap in prevalence rates of such sub-regions. This explains the results obtained in the previous chapter based on the I.I.P.S. target setting exercise.

Another finding is that the convergence of $\theta$ (t) is rapid if the attrition rate and/or the growth rate are high. That this must be so has already been pointed out earlier, based on eq. (V.4). In absolute terms, the initial growth rate cannot vary much (it would generally be between .01 and .03). However, the attrition rate can, in fact, vary considerably - it would be very low, near .05, if

the acceptance is principally that of sterilization and .3 or higher if mainly that of the intra-uterine device, since in the latter case both discontinuation and aging would contribute to attrition. When the attrition rate is large, any advantage a population with a high initial prevalence level enjoys gets eroded very fast with the result that it becomes easier for other populations to catch-up. But this is not a desirable situation since a high attrition rate demands a very high acceptance rate as well if the desired prevalance level is high.

# CHAPTER VI

# CONCLUSIONS

The results of the previous chapters, taken together, state that the targets need not be related to the past acceptance levels, but rather are principally dependent on the desired prevalence level and the rate of attrition, as long as the period allowed to reach the goal is not too short. Moreover, an acceptance schedule as given in eq. (V.3) of the previous chapter very rapidly leads to the desired goal of contraceptive prevalence. Before the implications of this are discussed, it is necessary to take cognizance of some loose ends.

The acceptance and use rates have been applied to the broad group of married couples (or women) of reproductive age rather than to conventional 5 yearage groups. But since the level of fertility varies considerably across age groups within the reproductive span, the age-distribution of users would also be important. If the contraceptive users are predominantly old, the impact on fertility would be less. Therefore, while translating a fertility goal into a desired prevalence level, age distribution of users should also be taken into account. Some target setting exercises follow this route, and therefore also specify the age distribution of acceptors. A problem that often

arises is that once the prevalence level is high enough, some age groups may reach a stage of near universal contraceptive use with the result that not many new acceptors can found in it. Such a situation can be handled by allowing change in the age distribution of acceptors over time. A linear programming approach has also been suggested for this purpose by Mukerji (1987).

The model given in the previous chapter, in its present form, is not equipped to handle age-specific prevalence rates. The main reason for this is that whereas in the ungrouped population new entrants could only be newly married women who must obviously be treated as non-users at the time of entry, if the population is distributed in 5 year age groups, entry into higher age groups would generally be from the younger women crossing the boundary of the age group, and some of these could possibly be users. Therefore, the number of users at a point of time (C (t)), could increase not just due to new acceptors as postulated earlier, but due to the transfer of users from the younger age group just below a reference group. The differential equation (V.2) then needs to be suitably modified. This introduces some complications in the mathematical treatment because the modified equation involves the prevalence rate of the lower age group as

well. The simplicity associated with the acceptance schedule is given in eq. (V.3) gets lost in the process, and therefore one would be better off by using the conventional target setting exercises rather than working with an appropriately altered form of eq. (V.3).

But the inability of the earlier formulation to prescribe targets in accordance with pre designated age-specific prevalence rates need not cause much concern for reasons described below. Though a number of patterns of age-specific prevalence would yield the desired fertility, not all of these would be realistic. When the contraceptive use is principally for limiting family size after a desired size has been achieved and the use is dominated by sterilization, the acceptance would take place at relatively higher ages in the reproductive span. The acceptors in the early phase of a family planning programme would generally be in their thirties (i.e., the wife's age would be in the 30s). Possibly, due to administrative pressures for targets, older couples would also be persuaded to accept methods, if there is not much scope for persuasion at younger ages. However, once the higher age groups are covered and if further improvements in prevalence are desired, the new acceptors must be drawn from younger age groups. Thus, the acceptance would, initially,

be dominated by older couples, there could possibly be some small rise in the mean age of acceptance for some time but later the mean age at acceptance would tend to fall. If the acceptance is predominantly for spacing purposes, the acceptors would come more from the middle and young age groups, as among the older couples the felt need for contraceptives would not be high due to an awareness of secondary sterility and very low fecundability. A rise in overall prevalence level would not, in this case, necessarily lead to a change in the age pattern of acceptors. But some temporary methods may be used with the intention of limiting, rather than spacing, child-bearing, and the acceptance may be on lines similar to that of sterilization. Any change in the age pattern would, however, be only gradual. For instance, in the Indian family planning programme the mean age at acceptance declined by about one year in the case of sterilization, and by two years in the case of IUD acceptance during 1973-1985, a period during which the prevalence rate rose substantially, by 20 percentage points (India, 1987; also see, Ram and Veeramatha, 1984, for an analysis for one of the states). Though for substantial further rise in prevalence rates the age distribution of acceptors must become younger, no large and rapid shift would be needed. Moreover, large shifts would also not be easy to

achieve. For example, if initially the acceptance is dominated by couples with wife's age in the thirties, later additions would have to be in and around these ages. Therefore, though in theory the specification of acceptors by age is preferable, in practice it is not so essential.

The results in Chapter IV show that the relationship between initial prevalence level and acceptor targets is weak when the target sets examined related to a goal that was to be achieved in 10 years or a longer time. The computations in Chapter V showed that the effect of initial prevalence is not felt after 15-20 years of an acceptor regime. Thus, if a long or medium-term goal is to be achieved, it makes sense to ignore the initial level of prevalence while setting targets. But what should be done if the goal is to be achieved in a short time ? If past performance is ignored, and acceptance targets specified in accordance with eq. (V.3), a region with low initial prevalence would have much lower prevalence level than a region with high initial prevalence, though the gap would narrow over time. Obviously, the target setting must be done in a different manner in such cases, and the various available procedures can be used for this purpose. Whether a substantial increase in prevalence rate can be

achieved in a short time or not needs to be seen, and if it is felt possible to do so, the targets specified; this brings us back to the issue of feasibility of targets and the demographic goal (for an excellent discussion, see Nortman, 1978). Otherwise, i.e., if the short time prescribed is considered inadequate, the general formula in eq. (V.3) could be invoked to set targets.

Now that certain limitations of the findings have been noted, one can examine the implications. First is that as long as the time allowed to reach the demographic goal is not very short, the targets need not depend on the past acceptance or the initial prevalence level. In fact, this could have been stated without any evidence, empirical or theoretical, because by, say, 30 years since the baseline, most of the earlier acceptors would have aged out of the reproductive period with the result that any advantage of past acceptance would have been lost. The data presented in Chapter V indicate that the role of past acceptance is weak even when the goal is to be reached in as short a period as 10 years. Therefore, the acceptor targets can be prescribed purely based on factors such as the desired level and need not make an allowance for the initial prevalence level.

In what manner these targets may be arrived at is given by the formula in eq. (V.3). This states that the annual rate of acceptance, a(t) can be given as: $a(t) = \theta_1(s(t) + r(t))$, where $\theta_1$ is the desired prevalence level, s(t) is the annual attrition rate and r(t) is the growth rate of married women of reproductive age. Both the attrition rate, and the growth rate are time dependent in this formulation. However, as long as the age distribution and the method-mix do not change much, the attrition rate will also not change. Besides, if the population is near-stable at the initial time, r(t) will also not change significantly in the early phase. This implies that the acceptance rate will remain more or less constant at $\theta_1 (s_o + r_o)$ where $s_o$ and $r_o$ are the attrition and growth rates during the early phase of a programme. Over time, both s(t) and r(t) are likely to undergo a change. Generally, as the prevalence rate rises, the age distribution of users will tend to become younger (though it may even become older during some short spells) and hence, if method-mix does not move towards temporary methods, the attrition rate will fall. Similarly, with the rising prevalence level inducing a fertility decline, the growth rate will also fall, though with some lag. If the goal is to reach the replacement level, r(t) will asymptote to 0 and therefore the acceptance rate in the long run will

equal $\theta_1 s_1$ where $s_1$ is the attrition rate in the long run (more appropriately $a(t) \longrightarrow \theta_1 \cdot s_1$ as $t \rightarrow \infty$ where $s_1$ is such that $s(t) \rightarrow s_1$ as $t \rightarrow \infty$ ). Thus, the acceptance rate will initially equal $\theta_1(s_o + r_o)$ and gradually decline (unless the attrition rate, $s(t)$, increases) to $\theta_1 s_1$. Since the value of $r_o$ would generally be quite small (1-3 per cent) as compared to the attrition rate, and the change in the attrition rate, from $s_o$ to $s_1$, also not likely to be large, the overall change from $\theta_1(s_o+r_o)$ to $\theta_1 s_1$ would also not be large. This implies, then, that the acceptance rate $a(t)$ would remain fairly steady and any change in it would only be very slow. The advantage, in terms of programme administration, is that the formulation given here would mean a more or less steady acceptance rate and demand for services rising steadily at a rate of growth equal to that of the number of couples of reproductive age.

Finally, how to put the formula into practice? Note that three values are needed: $\theta_1$, $s(t)$ and $r(t)$, Following the discussion in the previous para, $s_o$, and $r_o$ may be used in place of $s(t)$ and $r(t)$ during the initial phase. $\theta_1$, the desired prevalence level, is jointly determined by the desired fertility level, the age

distribution, the marital status distribution, fertility in the absence of contraception, and effectiveness of the contraceptives used. If the long term goal is to reach a replacement level fertility, then the expected level of mortality must be taken into consideration to arrive at the desired fertility level. Since the expected mortality as well as age-marital status distributions may vary across populations, the value of $\theta_1$ could also vary. For developed countries with near replacement fertility, short breastfeeding, relatively late marriage, and low abortion rate, the prevalence level normally falls in the range 65-80 per cent (Bongaarts and Stover, 1986) and for the states in India in the range 49-69 per cent (from Srinivasan et.al., 1980). Therefore, a value of $\theta_1$ will have to be chosen based on some knowledge about breastfeeding, marriage and contraceptive effectiveness. For India, a value of 60 per cent provides a good approximation (the official family planning goal is to reach this level which is equivalent to a replacement level fertility).

The attrition rate s(t), (and its initial value $s_o$) is heavily influenced by the method mix and by the age distribution of acceptors (it is also influenced by the level of mortality but since adult mortality is quite low, the extent of influence is quite small). In the case

of sterilization, if the mean age at acceptance is around 30, the users would generally be older and hence ageing would be rapid. However, since there would be hardly any discontinuation, the overall attrition rate would remain fairly low, around 5-7 per cent per annum. On the other hand, the acceptors and users of the intra-uterine device are generally younger and there would not be much attrition due to ageing. But discontinuation in this case would be quite high and hence the overall attrition rate would also be high - often 30-40 per cent per annum. Ignoring methods such as oral pill and condom that need regular use (and an adjustment for which is proposed later), the attrition rate (of sterilization and IUD together) would vary between 5 and 40 per cent, would be near the lower end if the use of sterilization dominates, and near the upper end if IUD use dominates. For the Indian family planning programme, which is sterilization dominated, this rate has been hovering around 10 per cent. This value can be used for $s_o$ for similar programmes; a higher value may have to be used if a programme is IUD dominated.

It is quite easy to get a good value for $r_o$, the annual growth rate of the number of married women of reproductive age. Unless the population has been severely

destabilized recently, this rate would not differ from the overall growth rate significantly. Moreover, census data would also give a good estimate of this parameter.

As mentioned above, some special treatment is needed to handle methods such as oral pills and condoms that need regular use. Some may use these methods regularly for prolonged periods, some may use these irregularly with frequent interruptions and some may use only occasionally. For the latter two groups, it is difficult to decide when a person is to be considered to have discontinued use, and when a fresh use (and acceptance) has begun. A more convenient way, therefore, is to examine only 'use' rather than 'acceptance' of such methods. In fact, because of this reason, the Indian family planning programme gives both the targets and the use in terms of equivalent person years of use, rather than number of acceptors or users. This can be incorporated into the target setting procedure as well. Out of the desired prevalence level $\theta_1$, some portion may be covered by such methods and the remaining by sterilization and IUD. If, for example, $\theta_1$ is 60 per cent, and about 10 percentage points is to be targetted for such methods, the remaining 50 per cent will have to be covered by sterilization and IUD. The

formula can then be applied with $\theta_1 = 0.5$ (50 per cent) instead of 0.6, and used to set sterilisation and IUD acceptance targets only.

The results have two implications for the family planning programme. One, since the targets need not be dependent on the current prevalence levels as long as other parameters such as method-mix and growth rate do not vary much across sub-regions, the targets can be allocated in proportion to the number of couples of reproductive age. Moreover, if the proportion of such couples in population is fairly constant in various sub-regions, the distribution of targets can be in proportion to the population of the sub-region. This means that once a target setting exercise has been carried out for a large region (or a state), there would be no need to obtain estimates (or guesses) for the values of s, r, and $\theta_1$. The targets can simply be distributed in proportion to the populations of sub-regions. But if it is felt that some sub-regions (say rural and urban regions) differ considerably with respect to some of the key parameters, there would be a need to use good estimates or guesses of these and compute the targets separately. The second important implication is that reaching a high prevalence rate would not lead to a drastic reduction in targets.

Even after such a level has been reached, a fairly high acceptor rate, $\theta_1 s_1$, which would not be much lower than $\theta_1 (s_o + r_o)$, is required just to maintain this high level.

Finally, the proposed formula (eq. V.3) is not to be treated as a perfect substitute for an elaborate target setting exercise. Rather, it should be considered as a rule of thumb to be used when other procedures are thought to be labourious.

# APPENDIX A

## DECOMPOSITION OF ACCEPTANCE RATE

The acceptance rate can easily be decomposed into three parts, namely, (i) acceptance needed to make up for attrition, i.e., losses due to ageing, discontinuation, and death, (ii) acceptance needed to make up for growth in the number of couples of reproductive age, and (iii) acceptance needed to raise the prevalence level. Following the notation in Chapter V, the acceptance rate is given by:

$$a(t) = \theta_1 \, (s(t) + r(t)) \, .$$

At time t, the attrition is $\theta(t)\ s(t)$, and the acceptance needed to make up for growth in the number of couples is $\theta(t)\ r(t)$. The balance contributes towards raising the prevalence level. Rewriting a(t),

$$a(t) = \big(\theta(t) + \theta_1 - \theta(t)\big) \cdot \big(s(t) + r(t)\big)$$

$$= \underbrace{\theta(t)\ s(t)}_{\text{(i)}} + \underbrace{\theta(t)\ r(t)}_{\text{(ii)}} + \underbrace{(\theta_1 - \theta(t))\ (s(t)+r(t))}_{\text{(iii)}}$$

the three components (i), (ii) and (iii) can be obtained.

It can be seen that, if s(t) is constant, component (i) rises as the prevalence level $\theta(t)$ rises. The

second component also rises with the prevalence level, but begins falling once the growth rate starts declining. The third component, the contribution towards raising the prevalence level, falls as the prevalence level approaches the desired goal of $\theta_1$. When the initial prevalence level is low, most of the early acceptance helps raise the prevalence level( (iii) is high), but soon attrition begins to make demand on acceptance and gradually, as $\theta(t)$ approaches $\theta_1$, most of the acceptance is needed to make up for attrition losses. As an illustration, time paths of the three components are given in Fig.A-1, for the case when the initial prevalence level is 0, the ultimate level $\theta_1 = 0.6$, $s(t) = 0.1$ for all t, $r(t) = 0.02$ for $0 \leq t \leq 20$, and falls linearly over the next 70 years to 0 (i.e., A = 20, and B = 70).

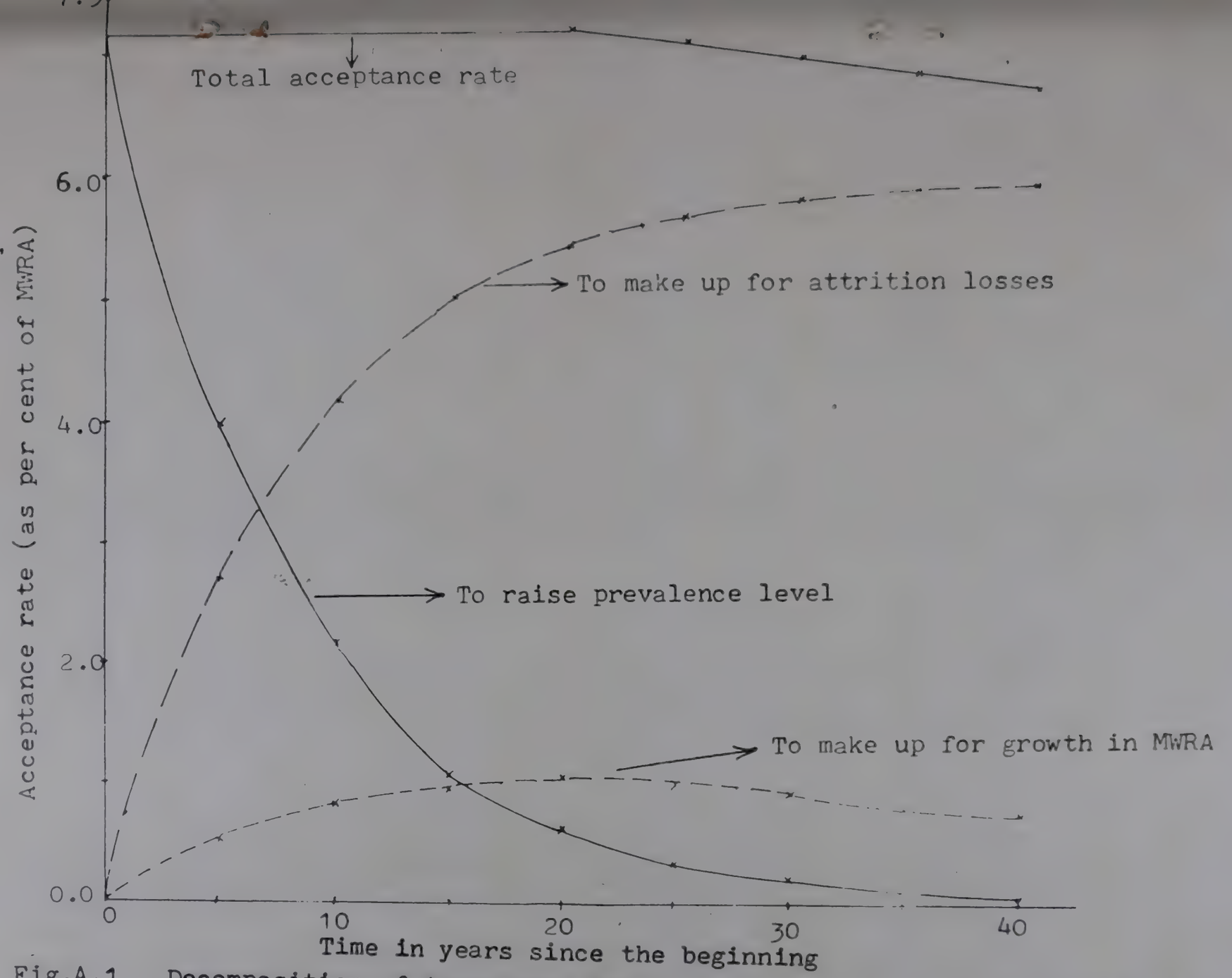


Fig.A.1 Decomposition of Acceptance Rate
(Constant parameters : Desired prevalence level = 60%, initial prevalence = 0 %
attrition rate = 10%, initial growth rate = 2%, linear
decline in growth rate).

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